Experimental Use of Apholate To Control Face Flies in Pastures And House Flies in Barns

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THE RESULTS of the experiments of a number of workers have indicated that flies and other insects are susceptible to the application of various kinds of chemosterilants applied topically or as an ingredient in bait (La Brecque 1961, Chamberlain 1962, Morgan and La Brecque 1962, Murvosh et al. 1964, Lindquist et al. 1964, Hair and Adkins 1964, Gouck and La Brecque 1963, Ristich et al. 1965, Ratcliffe and Ristich 1965, and others).

These contributions have been valuable in helping to evaluate the merits of the different materials and methods of application in effecting sterilization of insects under controlled conditions.

There is also a need for information regarding the practicality of using some of the more efficient chemicals and methods of application in the field. Several investigators (La Brecque et al. 1962, 1963, and Gouck et al. 1963) have demonstrated that the fertility of the house fly, *Musca domestica* Linnaeus, was appreciably affected when a chemosterilant bait was made constantly available under field conditions.

This bulletin presents the results of experiments conducted in northern West Virginia (1963 and 1964) using apholate baits in an attempt to control the face fly, *Musca autumnalis* De Geer, and the horn fly, *Haematobia irritans* (Linnaeus), in pastures, and the house fly in livestock barns.

Procedure and Methods of Applications of Apholate in Pastures (Face Fly Experiments 1963). In order to find a face fly attractant to use in this investigation intensive experiments were conducted in the field in 1963 and 1964. Various natural substances of animal and plant origin alone, and in combination with chemicals, were applied both on and off the bodies of cows in a randomly selected block design. The

results of these tests are quite extensive and are being published elsewhere. Processed enzymatic casein hydrolysate and whole soluble bovine blood were effective under field conditions, and they were selected for use in the apholate baits. Preliminary field experiments using apholate for face fly control were started late in the summer of 1963.

On July 15, 15 platform-type bait stations (Figure 1) were installed in Pasture No. 3 (70A, containing 40 cows) adjacent to cattle resting places. Each station consisted of a plywood board (16 in. square) painted white and mounted 8 ft. above the ground on posts or dead trees. Each platform was provided with a permanently mounted metal pie pan (5 in. diameter) to hold the dry apholate bait. Ten days later (August 25) a 1-pint chicken fount-type glass container was also installed on each platform to contain the liquid apholate bait. Both types of containers were provided with 3/4-inch mesh hardware cloth for bird shields, and each dispenser was protected from rain by a transparent, cellulose acetate shield (Figure 1). The dry baits were replenished twice and the liquid baits once during the observation period (July 29 to September 12).

Ten apholate dry bait stations were also installed in Pasture No. 2 (10A, containing 15 cows) on July 15 in the same manner described for

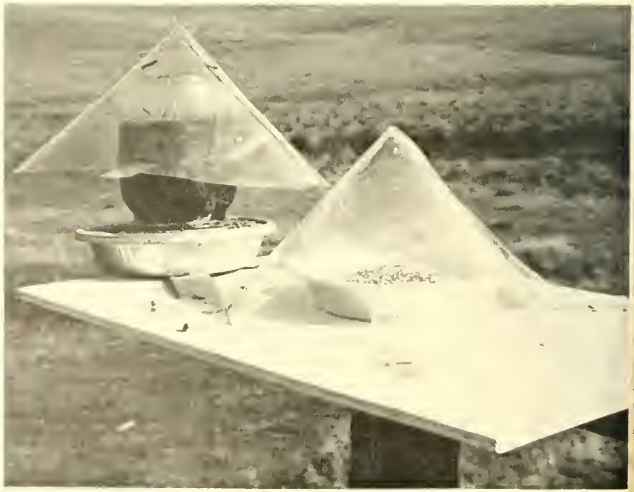

Figure 1. Platform-type bait station.

Pasture No. 3. The bait was not replenished, but it was stirred at weekly intervals.

The dry apholate bait consisted of corn meal containing 2.0 per cent apholate mixed with processed enzymatic casein hydrolysate (treated 1 hour in a 120° F oven) and whole soluble bovine blood in the following proportions (2 lbs. total): corn meal (0.50 lb.) (2.0 per cent apholate-treated); casein hydrolysate (1.0 lb.); and whole soluble bovine blood (0.50 lb.). The liquid apholate bait consisted of 10 per cent processed enzymatic casein hydrolysate, 3.0 per cent apholate and water.

The third pasture (No. 1, 70.A), which contained 35 cows, was located 1.5 miles from Pastures No. 2 and 3, and it was not treated for fly control (nor were the cows).

(*Face Fly Experiments* 1964). Only Pasture No. 3 (70.A, accommodating 45 cows) was utilized for field experiments for face fly control with apholate bait in 1961. Fifteen platform-type bait stations similar to those used in 1963 were installed on June 15 in the manner described for 1963. The platforms were painted brownish-red and the posts were equipped with two wooden slats (4 in. x 24 in.) placed obliquely under each platform. One was painted bright red and the other light blue for attracting purposes. Each platform was equipped with both liquid and dry apholate bait dispensers similar to those used in 1963.

The dry apholate bait was the same as that applied in 1963. One of the liquid baits was prepared by mixing 2 oz. of 30.0 per cent apholate in 112 oz. of water then stirring in 4 oz. of dry processed enzymatic casein hydrolysate and 16 oz. of 10.0 per cent whole soluble bovine blood. A second liquid attractant consisted of a mixture of 120 oz. water, 1 oz. of dry processed enzymatic casein hydrolysate, and 1 oz. of dry whole soluble bovine blood. A small container (1 oz.) of it was placed in the medial portion of each dry bait pan. All apholate baits and attractants were replenished at weekly intervals during the observation period 6-23 to 8-26.

Pasture No. 1 was utilized again in 1961 as an untreated pasture.

Procedures and Methods of Applying Apholate in Barns (*House Fly Control Experiments* 1963). Barns selected for experimental house fly control apholate were inhabited by either hogs, sheep, or cattle. Barn No. 1 (8,000 sq. ft.) housed 40 sheep in individual stalls. Twenty-six pie pans (5 in. diameter) were installed (6-15) on rafters 10 ft. above floor level at locations throughout the barn. Each pan contained 2.5 oz. of dry 2.0 per cent apholate-cornmeal bait, 73.0 per cent dry processed casein hydrolysate, 9.0 per cent; and dry, whole soluble bovine blood, 18.0 per cent. This bait was applied only once and was not replenished during the observation period (7-15 to 9-9).

Barn No. 2 (3,000 sq. ft.) accommodated 20 cows for one hour twice daily. Fifteen pie pans each containing 3 oz. of dry cornmeal bait (same as used in Barn No. 1) were installed (6-28) throughout the barn at a level of about 8 ft. above the floor. Only one dry bait application was made during the observation period (7-16 to 9-9). On July 26, 500 ft. of string treated (dipped and dried) with an aqueous (37.0 per cent) mixture consisting of 3.0 per cent apholate, 50.0 per cent sugar, and 10.0 per cent processed casein hydrolysate was suspended horizontally over the stanchions out of reach of the cows.

Barn No. 3 (2,000 sq. ft.) accommodated 15 sows with pigs. On July 14, 15 pie pans, each containing 2.5 oz. of dry cornmeal bait (same as used in Barn No. 1), were installed near the ceiling on rafters around the inside of the barn. Seven similar bait stations were installed outside the main barn in adjacent open sheds. These baits also were applied only once during the observation period (7-15 to 9-9).

Barn No. 4 (8,000 sq. ft.) housed 100 sows with pigs. On June 23, 15 pie pans (5 in. diameter), each containing 3.0 oz. of the 2.0 per cent apholate dry sugar bait (same as used in Barn No. 1), were installed 7 ft. above the floor level at locations throughout the barn. Six hundred fifty feet of treated cotton string (treated as described for Barn No. 2) was installed horizontally through the barn over the hog stalls. Each apholate treatment was applied only once during the observation period (7-13 to 9-9).

(*House Fly Control Experiment* 1964). In 1964, two hog barns were selected for experiments using apholate for house fly control.

Barn No. 1 (8,000 sq. ft.) housed 100 sows with pigs. On June 1, four flat cake pans each containing 1.0 lb. of dry sugar bait treated with 1.6 per cent apholate and a red dye (erythrosin-B) were installed in the barn about 4 ft. above floor level out of reach of the hogs. The sugar granules were large (1/16 in.) and the small amount of erythrosin-B (dye) was added to the bait as a visual attractant. This made it easy to observe the reddish sugar solution in the gut of the fly to visually confirm feeding activities, and sugar colored in this manner seemed to attract more flies than white sugar used in baits in other barns. Four additional bait pans were installed on July 30. The dry baits were stirred each week and the original pans were replenished on August 1. On June 1, 3,200 ft. of cotton string treated with apholate (95 mg/ft.), with casein hydrolysate and sugar as attractants, was installed horizontally over the hog pens. The string was removed on July 23 and 3,200 ft. of 1 in. fiber glass ribbon, treated with apholate (102-146 mg/ft.) with white corn syrup as an attractant, was installed in place of the string. The barn was logged with

dichlorvos (0.25 per cent) on July 14 and 27 to reduce excessive adult fly populations.

Barn No. 2 (6,000 sq. ft.) housed 200 shoats. On June 1, six pie pans, each containing 2.0 lbs. of dry sugar bait (same as used in Barn No. 1), were installed at locations throughout the barn. Six additional similiar bait pan sites were installed on July 27, and the baits in the six pans installed on June 1 were renewed. These baits were stirred each week. Also on June 1, 2,400 ft. of apholate-treated string (same used in Barn No. 1) was installed over the pens, horizontally, near the low ceiling. On August 13 the bait strings were replaced with 1 in. fiber glass ribbon treated with apholate as described for Barn No. 1. Barn No. 2 was also fogged on July 14 and 27 to reduce heavy populations of adult flies.

Methods of Evaluating the Effectiveness of Apholate Applied in Pastures and Barns (*Face Fly Control* 1963). The experimental herds in Pastures No. 1 and 2 were visited at least once each week in the afternoon for the purpose of making adult face fly and horn fly counts. The animals were approached as closely as possible on foot or by automobile. Face fly counts were taken from the face only; horn fly counts were taken from a 1 ft. square area on the withers or back of the animal. Binocular-type field glasses were used to facilitate the counting procedure on the wilder cows. The results of these counts are summarized in Table 3 (1963).

The effectiveness of field applications of apholate for face fly control was also measured by collecting numbers of adult face flies from the cows in treated and untreated pastures for egg viability observations. Fly collections were made three times during the observation period (8-16, 8-29, and 9-11-63). For this purpose four gentle dairy heifers were tied to posts of a fence which separated them from the herds of cows in Pastures No. 1 (untreated), 2 and 3 (both treated). Their backs were treated in spots with an attractant prepared from processed enzymatic casein hydrolysate and whole soluble bovine blood mixture (water 70.0 per cent, casein hydrolysate 20.0 per cent, bovine blood 10.0 per cent). Soon after application of the attractant large numbers of face flies could easily be collected in transparent plastic cages from the backs of the animals. The flies were taken to the laboratory and placed in oviposition cages provided with 0.5 pt. paper cartons filled with fresh cow manure. The manure was examined at 24 and 48 hr. intervals, and the eggs were recovered and placed in rows on moist blotter paper in petri dishes. The eggs were examined once a day for five days, and the total number of hatched and unhatched eggs for each collection was counted (very little hatching occurred after the third day). Table 2 presents the results of these viability evaluations.

TABLE 1

Effect of the Application of Apholate Baits in the Field on the Viability of Eggs Depasited in Manure (Face Fly Puparia Recovered from Manure) 1963

Treatment[a]	Average number puparia recovered from 12 samples, each pasture, each of 7 collection dates[b] 8-7 to 9-18-63
Untreated Pasture, No. 1	3.49b[c]
Dairy Science Pasture, No. 2	3.37b
Animal Science Pasture, No. 3	0.30a

[a]Treatments started in Pastures 2 and 3 on 7-15-63.
[b]Collections made two days later from 12 randomized manure deposits in which eggs were deposited in the morning after daylight; sample size approximately 1.0 pint.
[c]Duncan's Multiple Range Test for Log (N + 1) of the data. Antilog of data means —1 is presented as the geometric average count; 5.0 per cent level of significance. Treatments sharing a common letter do not differ in effectiveness.

TABLE 2

Effect of Apholate Baits[a] in the Field on the Viability of Eggs from Field-Collected Face Flies, 1963

Face Fly Collection Date	No. Eggs Collected	Per Cent Non-Viable	Ho. 20.0 Per Cent or Less[b] Accept	Reject
8-16 (Dairy Science) Pasture 2	61	85.0		X
8-29	79	0.0	X	
9-11	56	100.0		X
8-16 (Animal Science) Pasture 3	652	3.0	X	
	418	25.0		X
9-11	57	89.0		X
8-20	540	1.0	X	
8-16 (Untreated) Pasture 1	385	25.0		
8-22	96	1.0		
8-29	740	49.0		

[a]Treatments started 7-15-63.
[b]Chi Square Test based on an average of 20.0 per cent non-viable eggs found in previous observations in pastures where no treatment was used.

(*Face Fly Control* 1964). Adult face fly and horn fly counts were made in Pastures No. 1 (untreated) and No. 3 (apholate treated) in a manner similar to that described for 1963. The results are summarized in Table 3 (1964).

Additional evaluations for face fly populations in Pastures 1, 2, and 3 were made by collecting morning-deposited manure (1.5 gal. total each pasture) from 12 randomly selected deposits. These sites were marked

TABLE 3

Effect of Apholate Baits[a] in the Field on Face Fly and Horn Fly Papulations (Adult Fly Counts on Cows) 1963 and 1964

Observation Dates (1963)	Pasture Number†	Av. Fly Counts[b] Face Fly	Horn Fly	Observation Dates (1964)	Pasture Number†	Av. Fly Counts[b] Face Fly	Horn Fly
7-29	1	15.8b*	7.2b**	6-23	1	9.1b*	4.6a
	2	5.7a*	0.30a**		3	1.3a*	1.4a
	3	6.1a*	9.0b**	7-1	1	2.7b*	2.4a**
8-6	1	13.8b*	7.1b*		3	0.24a*	4.9b**
	2	8.2b*	0.37a*	7-9	1	5.7b*	6.9a
	3	6.0a*	12.2b*		3	1.0a*	6.7a
8-12	1	9.0b**	4.0b*	7-15	1	2.0a	2.7a
	2	4.8a**	0.50a*		3	2.1a	8.3a
	3	6.9b**	0.40a*	7-22	1	5.8a	7.1a**
8-20	1	9.0b*	5.2b*		3	1.0a	19.5b**
	2	4.6b*	0.0a*	7-29	1	7.7b*	2.7a*
	3	4.3a*	9.0b*		3	2.4a*	21.2b*
8-30	1	7.5a	1.9b*	8-5	1	6.7a*	14.7a
	2	5.2a	0.30a*		3	14.7b*	12.1a
	3	7.6a	3.1b*	8-13	1	5.8a	7.9a
9-5	1	6.0b**	5.8b*		3	3.2a	21.8a
	2	10.0b**	0.32a*	8-19	1	10.5a	19.7a
	3	5.3a**	3.9b*		3	7.0a	12.1a
9-12	1	8.0b*	12.7b*	8-26	1	11.5a	11.0a
	2	11.6b*	0.43a*		3	12.0a	10.0a
	3	3.0a*	12.0b*				

[a]Treatments were started 7-15 in 1963 and 6-15 in 1964.
[b]Duncan's Multiple Range Test for Log (N + 1) of the data. Antilog of data means —1 is presented as the geometric average fly count. Counts sharing a letter in common do not differ significantly. These results are based upon observations of flies on 8 cows in the untreated pasture and 15 cows in each of the treated pastures.
*1.0% level of significance.
**5.0% level of significance.
†Pasture No. 1 untreated. Pastures Nos. 2 and 3 treated apholate.

with small, brightly colored flags on 18-inch steel rods so that the deposits could be found and collected two days after deposition. The manure was placed in 1-pint round, paper cartons which were placed above metal chutes which channeled the mature maggots into moistened sand when they crawled out of the cartons. The maggots were permitted to enter the pupal stage. The puparia from each pasture (No. 1, 2, and 3) were then sorted, and the face fly puparia identified and counted. Table 1 summarizes the results of these face fly puparia counts.

(*House Fly Control* 1963). The viability of house fly eggs from flies collected in experimental barns in 1963 and 1961 was determined

by collecting adult flies with a sweeping net in molasses-feed-baited areas within the barns. The flies were placed in screened cages provided with oviposition-feeding sites. These sites (two per 12 x 12-inch cage) consisted of a 1-pint paper carton equipped with a sugar-milk saturated section roll of absorbent paper. These sites were examined for eggs daily for at least three days. The eggs collected were placed in rows on moistened blotter paper in a petri dish, the top (cover) was placed on the dish, and the eggs were observed daily for three days. The hatched and unhatched eggs were counted from each collection location (four barns in 1963 and three in 1964). The results of these viability evaluations (Chi Square Test) are presented in Tables 4 and 5. In all of the analyses, the natural, non-viable rate was designed as 20.0 per cent (in a series of observations it was determined that non-viability of house fly eggs collected from flies in untreated barns ranged from 16.0-20.0 per cent). If the sterility value in the experiments exceeded 20.0 per cent it was assumed that the apholate treatments affected the viability of the eggs and the hypothesis rejected that this occurrence was by chance.

Results of Fly Control Treatments (Face Fly). There were 92.0 per cent fewer puparia recovered from manure collected in Pasture No. 3 which had both dry and liquid apholate bait applications than from the untreated Pasture No. 1 (Table 1). Manure from Pasture No. 2, which received only dry bait applications, provided about the same number of puparia as were recovered from the untreated pasture (No. 1).

The non-viability of eggs from field-collected face flies varied from 0.0-100.0 per cent in Pasture No. 2 (dry apholate bait) and 1.0 to 89.0 per cent in Pasture No. 3 (dry and liquid baits). The non-viability rate of the eggs recovered from flies collected in the untreated pasture ranged from 1.0 to 19.0 per cent. The highest rates of non-viability for certain dates were in the treated pasture, but the results were too erratic to be actually significant (Table 2).

The apparent effect of dry apholate bait on the viability of the eggs of face and horn flies in Pastures No. 2 and 3 varied considerably (Table 3). The effect was more apparent in face fly than in the horn fly populations. As compared with Pasture No. 1 (untreated) significant differences in face fly counts ranging from 6.0 to 91.0 per cent occurred five times in 10 observations dates from June 28 to August 26 in Pasture No. 2 (untreated). Hair and Adkins (1964) found that complete sexual sterility resulted from feeding adult face flies 1.0 per cent apholate for one day. Hair and Turner (1966) showed in laboratory experiments that sterility in both sexually mature and recently emerged face flies can be appreciably affected.

(*House Fly Control* 1963). Dry apholate bait had an appreciable effect in reducing house fly populations in barns housing livestock. During eight observation dates (egg collections) from 7-15 to 9-9-63, including 18 egg-hatching experiments, there were 10 significant sterility readings which varied from 28.0 to 100.0 per cent in Barn No. 1 (Table 4).

In a similar experiment in Barn No. 2 (containing 20 cows) house flies were collected nine times from 7-16 to 9-9-63. They produced a total of 3,649 eggs from which viability evaluations were made 22 times. Sterility effects ranging from 23.0 to 86.0 per cent were observed nine times (Table 4).

A large hog barn (Barn No. 3) treated with both dry apholate bait and apholate-sugar bait-treated strings suspended horizontally from the ceiling showed significant sterility effects (ranging from 27.0 to 100.0 per cent) in 25 out of 34 egg batch evaluations from 7-13 to 9-9-63 (Table 4). Flies which produced these eggs (25,914 total number) were collected from barns 14 times from 7-15 to 9-9-63.

A hog barn (Barn No. 4) containing 100 sows with pigs treated in 1963 with apholate-treated string (baited with sugar) suspended horizontally from the ceiling produced significant sterility effects (ranging from 29.0 to 92.0 per cent) in 9 out of 12 eggs deposit evaluations from 7-23 to 9-9-63 (Table 4). A total of 14,598 house fly eggs was included in this evaluation.

(*House Fly Control* 1964). During the period 6-24 to 7-28-64 eggs deposited by house flies collected in two hog barns (No. 1 and No. 2) were pooled for viability evaluations. These barns were both treated with dry apholate sugar bait and apholate-sugar bait-treated string suspended horizontally from the ceilings. Flies were collected six times (6-24 to 7-28) and the viability of 12 batches of eggs, totaling 1,345 was evaluated. Significant sterility effects (ranging from 11.0 to 100.0 per cent non-viability) were observed in 10 of the 12 batches (Table 5)

House flies were collected from Barn No. 1 five times (8-4 to 9-16-63) and significant sterility effects (ranging from 31.0 to 99.0 per cent non-viability) were observed in all nine batches of eggs (2,208 total) produced by these flies (Table 5).

From 8-4 to 9-16 the eggs from house flies collected in Barns No. 1 and No. 2 were incubated separately for viability evaluation. The eggs from Barn No. 2 (seven house fly collections 8-4 to 9-16-64) manifested significant sterility effects (ranging from 12.0 to 100.0 per cent non viability) in all 28 batches, totaling 11,977 eggs (Table 5).

TABLE 4

Effect of Apholote Treotments on the Viability of House Fly Eggs in Livestock Barns (1963)

Egg Collection Dates	Number Eggs	Per Cent Non-Viable*	Ho. 20.0 Per Cent or Less	
			Accept	Reject
Barn No. 1				
(30 Sheep)				
7-15	15	0.0	X	
7 22	18	11.0	X	
	35	91.0		X
	19	100.0		X
7-30	208	75.0		X
	268	66.0		X
	174	61.0		X
	370	17.0		X
8 12	271	94.0		X
8 19	88	13 0	X	
	347	10 0	X	
	111	91.0		X
8-26	263	28.0		X
	185	60 0		X
9 3	163	1.0	X	
9 9	162	3.0	X	
	166	8.0	X	
	153	24.0	X	
Barn No. 2				
(20 Cows)				
7 16	1748	2.0	X	
7-22	708	13.0	X	
	968	13.0	X	
	658	6.0	X	
	270	12.0	X	
	142	35 0		X
7 29	700	72.0		X
	1066	83.0		X
	296	42.0		X
	223	77.6		X
8 5	131	71 0		X
	251	86 0		X
8 12	166	7.0	X	
	279	23.0		X
8 19	104	6 0	X	
8 26	296	20.0	X	
	2336	10.0		X
9 3	949	10.0	X	
	352	5.0	X	
9 9	71	0.0	X	
	89	0.0	X	
	162	0.0	X	

TABLE 4 (Continued)

Egg Collection Dates	Number Eggs	Per Cent Non-Viable[a]	Ho. 20.0 Per Cent or Less	
			Accept	Reject
Barn No. 3				
(15 Sows with Pigs)				
7-13	264	51.0		X
	125	36.0		X
	84	76.0		X
7-15	86	43.0		X
	51	0.0	X	
7-16	119	75.0		X
7-22	234	11.0	X	
	133	27.0		X
	24	46.0		X
7-23	59	100.0		X
	1843	88.0		X
	686	62.0		X
	135	90.6		X
7-29	3743	71.0		X
	2475	85.0		X
	2937	78.0		X
	2093	99.0		X
	1723	82.0		X
8-5	580	52.0		X
	903	50.0		X
8-12	667	79.0		X
8-12	777	19.0	X	
	281	42.0		X
	173	97.0		X
8-19	79	3.0	X	
	146	49.0		X
8-26	90	2.0	X	
	804	20.0	X	
8-26	125	3.0	X	
9-3	197	3.0	X	
	305	2.0	X	
9-9	1145	13.0		X
	1351	68.0		X
	877	27.0		X
Barn No. 4				
(100 Sows with Pigs)				
7-23	158	92.0		X
	116	78.0		X
7-29	2815	73.0		X
	2155	88.0		X
	3110	89.0		X
	916	65.0		X
8-5	970	16.0	X	
	1161	42.0		X
	2215	82.6		X
8-12	384	9.0	X	
	201	29.0		X
9-9	97	1.6	X	

[a]Chi Square Test based on observations of the viability of [illegible] similar, untreated barns where the average non-viability was [illegible]

Discussion and Conclusions

One of the difficulties in using a chemosterilant in the field for insect control in a practical way is the problem of efficacious application. The chemical must be accessible to the insect, and it has to be presented in an acceptable manner with an attractant which can compete with the natural odors, warmth, moisture, and other attractive characteristics of the host and the environment. In this experiment the apholate had to be inaccessible to the host animals (cows, sheep, and hogs) but accessible and attractive to the flies. The odor from the whole soluble bovine blood used in the apholate bait (for face fly and horn fly control in the field) attracted and excited the cows in an unusual manner, and the bait containers had to be securely stationed at least 8 ft. above ground to exclude the cows. In the control experiments with face and horn flies using apholate baits applied in the pastures, face flies were infrequently observed visiting the baits stations, and horn flies were rarely observed on any

TABLE 5

Effect of Apholate Treatments on the Viability of House Fly Eggs in Hog Barns (1964)

Egg Collection Dates	Number Eggs	Per Cent Non-Viable[1]	Ho. 20.0 Per Cent or Less	
			Accept	Reject
Barns No. 1 and No. 2[2]				
(200 Shoats)				
6-24	371	3.0	X	
	178	1.0	X	
6-30	57	100.0		X
	539	51.0		X
	444	55.6		X
7-6	476	44.0		X
	301	72.0		X
7-14	402	66.0		X
	384	68.0		X
7-21	264	46.0		X
	128	59.0		X
7-28	804	18.0		X
Barn No. 1				
(100 Sows with Pigs)				
8-4	254	94.0		X
	87	83.0		X
8-11	126	76.0		X
	455	64.0		X
8-18	136	99.0		X
9-8	116	91.0		X
	126	98.0		X
9-16	844	15.0		X
	64	34.0		X

TABLE 5 (Continued)

Egg Collection Dates	Number Eggs	Per Cent Non-Viable[a]	Ho. 20.0 Per Cent or Less Reject
Barn No. 2			
(200 Shoats)			
8-4	223	100.0	X
	135	96.0	X
8-11	505	85.0	X
	235	80.0	X
8-18	54	100.0	X
8-25	580	90.0	X
	166	91.0	X
	598	89.6	X
	897	90.0	X
	807	88.0	X
	471	88.0	X
9-31	263	98.0	X
	417	70.0	X
	772	80.6	X
	543	78.0	X
	134	91.0	X
	412	82.0	X
	422	89.0	X
9-8	196	75.0	X
	455	52.0	X
	296	71.0	X
	145	100.0	X
9-16	553	83.0	X
	564	67.0	X
	873	66.0	X
	550	12.0	X
	411	53.0	X
	300	59.0	X

[a]Chi Square Test based on observations of the viability of house fly eggs from similar, untreated barns where the average non-viability was 20.0%.
[b]Eggs collected from Barns No. 1 and No. 2 pooled on each collection date (6-24 to 7-28); treatments the same as described in Table 4, for Barns No. 1 and No. 2.

of the bait formulations. It is believed that if the apholate-bait mixtures could have been safely presented for the cows at lower positions (1 ft. above ground or lower) they would have been more effective against face flies. More effective attractants are needed for the field application of chemosterilants to control face flies and horn flies. Harris and Frazar (1966) demonstrated that adult horn flies can be completely sterilized with apholate, both by feeding and topical application.

In general, liquid bait formulations were more attractive to face flies than dry formulations, but were much more difficult to maintain in the dispensers because of evaporation. House flies were effectively attracted to some of the apholate-sugar baits used in the livestock barns. The apholate-sugar-treated cotton strings and fiber glass tapes were readily accepted as resting and feeding sites by the flies (Figure 2).

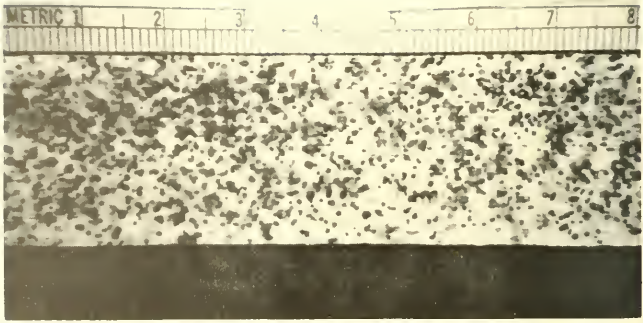

Figure 2. Apholate-sugar-treated fiber glass tape showing fly visitation specks.

House fly populations can be greatly reduced in some barns by applying apholate baits early in the fly season and continuing the operation to the end of the season. The viability of the eggs of the indigenous fly populations can be greatly reduced; however, this fact was not correlated with an adequate reduction of house fly populations in these experiments. In extreme fly population situations, such as exist in hog barns, the demands on the efficiency of a chemosterilant are heavy, and until more effective chemosterilants and/or a more efficient method of presenting the chemosterilant is ascertained, supplemental fly control measures will be required. Hansens and Granett (1965) also recognized the advantages of sterilization techniques in house fly control and their results indicated that adequate fly control in barns having favorable fly breeding conditions could not be achieved with chemosterilants alone.

The use of chemosterilants under field conditions for the control of insect pests affecting man and other animals has an interesting potential and merits additional investigational efforts.

SUMMARY

Field experiments were conducted in 1963 and 1964 using apholate baits to control the face fly, *Musca autumnalis* De Geer, and the horn fly, *Haematobia irritans* (Linnaeus), in pastures and the house fly, *M. domestica* Linnaeus, in livestock barns.

In the face fly control experiments both dry and liquid apholate baits were applied on elevated bait stations distributed throughout the pastures near resting or watering sites.

The baits used in house fly control experiments in barns were of two types. One was a dry mixture containing apholate; in the other, cotton strings and fiber glass tapes were treated with an apholate-attractant mixture. A combination of both types was used in some of the barns.

Apholate baits applied as described affected the viability of face fly eggs, but not horn fly eggs. The viability of house fly eggs was appreciably affected in some situations and populations were greatly reduced in some of the barns having continuous applications of the baits started early in the fly season.

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CAUTION

The chemosterilant used in these experiments was apholate 2,2,4,4,6,6-hexakis (l-aziridinyl) -2,2,4,4,6,6-hexahydro-1,3,5,2,4,6-Triazatri-hosphorine) . It is an alkylating agent and can be dangerous if handled r administered carelessly. The baits were carefully dispensed so that hey were easily accessible to the flies, but inaccessible to livestock in the xperimental areas.